C1850-2

SIX DOLLARS

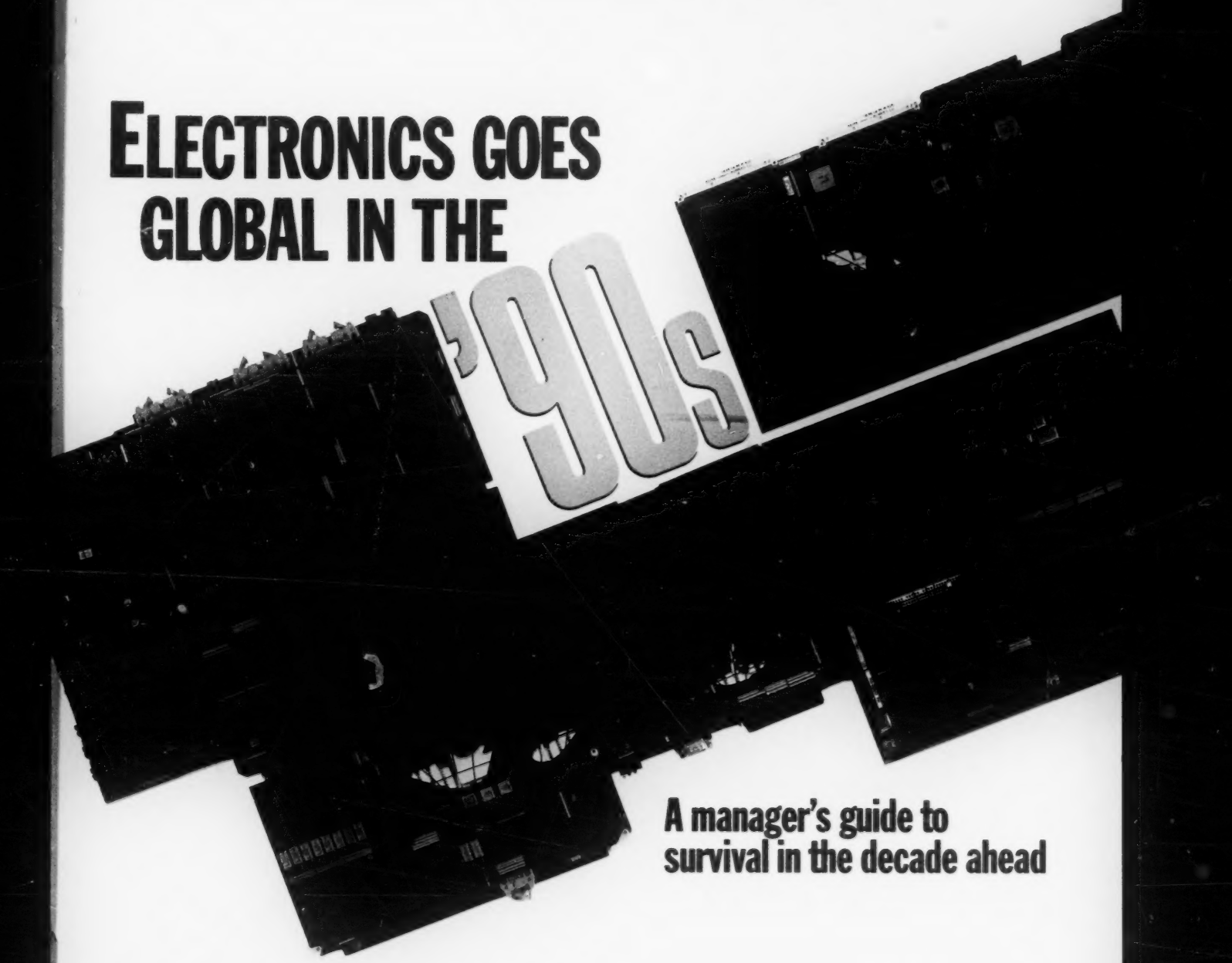
A CAHNERS PUBLICATION

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

DECEMBER 11, 1989

ELECTRONICS GOES GLOBAL IN THE '90s

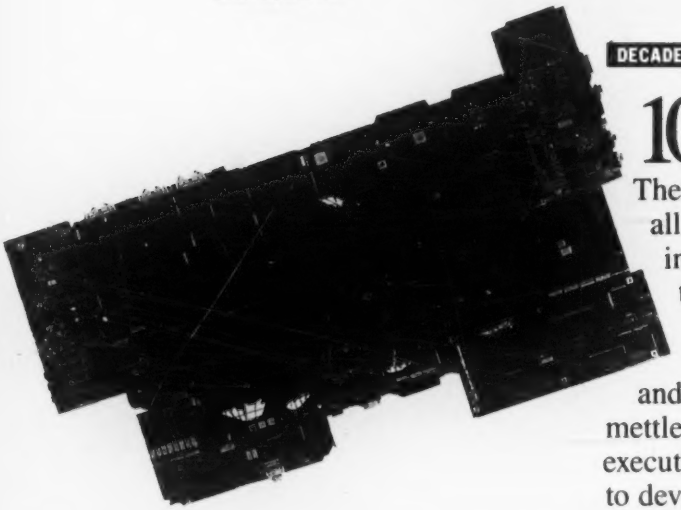


A manager's guide to survival in the decade ahead

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES — WORLDWIDE

VOL. 15, NO. 24 DECEMBER 11, 1989



Cover: Multibus and ATbus microcomputer boards courtesy Intel Microcomputer Co., Hillsboro, Ore.; map painting, Draw the Line Productions; photograph, Dave Bradley

DECADE OF THE 1990s

10 Global challenges and promises in the 1990s

The new decade will affirm once and for all the global character of the electronics industry, offering changes and challenges that were unimaginable even five years ago. The ever-increasing international competition, rapid technology advances and shifting labor conditions all will test the mettle of electronics companies and their executives and managers. Companies will have to devise new long-term strategies to stay ahead of the unprecedented growth promised by the '90s.

DECADE OF THE 1990s

16 A new global economic order comes of age by the 1990s

The '90s will be a decade of economic reckoning. Some of the key questions: Where will the United States fit in the rapidly evolving global economy? Will the U.S. accept a more equal economic world? Will there be a harmonious economy devoid of protectionism and nationalism? Or will trade conflicts stifle growth for all?

20 Viewpoints: Of Europe 1992 and a U.S. industrial strategy

Lester Thurow of MIT and Claude Barfield of the American Enterprise Institute for Public Policy Research offer contrasting viewpoints on key 1990s issues. Thurow writes about the effects of the unification of Europe on U.S. business, and Barfield describes the need for U.S. companies to develop a long-term industrial strategy.

MARKETS FOR THE 1990s

26 Electronics in the '90s: More new technologies, markets

Thinking back to 1979, the world of electronics was a simple one — no workstations, LANs or personal computers. But much has changed in the past 10 years. In the '90s, the incredible speed of innovation will race along even faster, and electronics will be the main engine driving the global economy.

32 Computers

Demand for computer support services and more versatile peripherals will accelerate.

33 Semiconductors

The applications for microprocessors and semiconductors will skyrocket.

34 Communications

Fueled by improved computers, standards and software, every niche is due to mushroom.

38 Components

The most successful companies will have to adjust to serving a global marketplace.

40 Consumer electronics

While hard pressed to match the growth of the '80s, there are still markets to be found.

44 Defense electronics

Real annual decreases in military spending are unavoidable.

46 Industrial automation

The demand for industrial electronic equipment will be strong in the decade ahead.

48 Electronic design automation

As this young segment matures, and growth ultimately slows, the market's structure is due for a change.

54 Issues for the 1990s:

GLOBAL TRADE ISSUES

58 Globalization forces changes in trade barriers of the past

As the world continues to "shrink" and nations' economies meld together, trade will play an even greater future role, especially in electronics. Even now, global markets are becoming the norm. The challenge for these integrated economies will be to weather the worldwide forces of inflation, debt and oversupply.

65 Japan

In the '90s structural advantages of Japan's industrial system will loom large.

67 Europe

Despite all the anticipation of the changes due from reunification of Europe, restructuring actually began about five years ago.

69 Pacific Rim

The Four Tigers — Taiwan, Hong Kong, Korea and Singapore — already face the same problems as industrialized nations.

73 Soviet Union

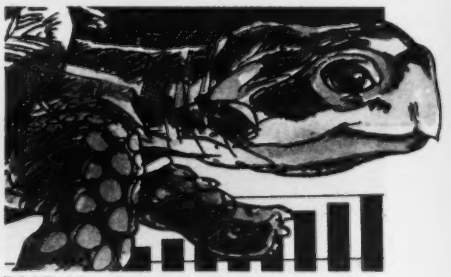
Undaunted by a myriad of restrictions, some would-be suppliers to the Soviet Union are forging ahead.

PAGE 102 Active federal role emerging on key industrial issues

PAGE 26 Electronics in the 1990s: Still more new technologies, markets

PAGE 78 Bethlehem Steel's Walter Williams: Will electronics take heed of lessons from other industries?

PAGE 92 SRC's James Freedman: Technologies ride a fast track into the 1990s



PAGE 16 Steady economic growth on the way to the year 2000

A manager's field manual

MANAGEMENT ISSUES

78 Lessons from other industries: Will electronics take heed?

The 1970s and '80s hit the nation's basic industries like steel, chemicals and automobiles hard. Surely in the '90s, the electronics industry will take its own hits. Managers at Ford, Bethlehem Steel and Monsanto tell how they survived and offer advice to electronics. But will electronics managers take heed?

83 Financing

Disenchanted with Wall Street's investment constraints, electronics companies will pursue highly innovative financing arrangements in the '90s.

85 Sites and facilities

There will be more regions wooing electronics plants and offices in the '90s, but areas with top educational institutions will remain favorites.

87 Distribution

As the '90s see more foreign players and the trend toward "bigness" plays itself out, the forecast for profits in the distribution business is dim.

TECHNOLOGY ISSUES

92 Technologies ride a fast track into the 1990s

Staying competitive in electronics means never resting easy when it comes to developing technology. As the search goes on for greater speeds, higher capacities and smaller sizes, much of the industry's hopes continue to depend on the silicon chip.

97 Standards

While observers expect near-universal adherence to standards by the turn of the century, the standards-development process is rife with divisiveness.

GOVERNMENT ISSUES

102 Federal role emerging on key industrial issues

The signs are all over Washington that government leaders will forsake their hands-off attitude toward U.S. industry in the '90s. Many in electronics believe such involvement is long overdue.

107 Education and demographics

As an industry that depends on highly skilled workers, electronics will be challenged by fundamental demographic and education problems.

STRATEGIES IN THE 1990s

112 Whither IBM: Can the giant reassert itself?

There was a time when Big Blue was the unquestioned pacesetter for the computer industry. But times have changed. The question is whether that trend will continue through the 1990s or if the giant can reassert itself. Analysts say IBM will have to do it in two critical areas — technology and pricing.

118 Industry pioneers offer guideposts for the future

As the 1990s dawn on the electronics industry, there's much to be gained from looking back on the past 10 years. Some pioneers of the '80s, Gene Amdahl, Sandra Kurtzig, Bill Norris, L.J. Sevin and Bill Poduska, describe what they learned in the 1980s and apply their insights to the 1990s.

DEPARTMENTS

5 **Inside Business**

127 **My View**
Comdex. Room for improvement

128 **Advertiser index**

131 **Business Barometer**
Leading indicator

132 **Viewpoint**
Why aren't you in Europe?

EDITORIAL STAFF

Publisher: Frank J. Burge

Editor: Jeffrey Bairstow

Managing Editors: J. William Semich, Roger C. Plant

Senior Editors: Linda Stallmann (Financial), Bruce C. P. Rayner, Rick Whiting, Barbara N. Berkman

Associate Editors: Anthony E. Greene, Michael R. Leibowitz

Assistant Editors: Peter L. Burrows, John McCreadie, Xiong Xiaoge

Section Editor: Marvin V. Greene

Copy Editor: Barbara Jorgensen

Research Editor: Michelle D. Doses

Contributing Editors: Elizabeth Baatz (Cahners Economics), Dwight Davis (Boston), H. Garrett DeYoung (Boston), Madeline Franchi (Cahners Economics), Sarah Glazer (Boston), Shohei Kurita (Tokyo)

Consulting Editors: Alberto Socolovsky, Allen Furst

Production Editor: Karen J. Covey

Editorial Assistant: Jean O'Brien

ART STAFF

Art Director: Michael Roach

Associate Art Director: Carla Aguilar Leeder

EDITORIAL OFFICES

Boston: Cahners Building
275 Washington Street, Newton, Mass. 02158
(617) 964-3030 Telex: 94 0573 CPC BSN
Fax: (617) 558-4327 MCI: EBBOS

Washington, D.C.: Anthony E. Greene
1333 F Street, N.W., Suite 720
Washington, D.C. 20004 (202) 628-2773

San Jose, Calif.: John McCreadie
Sherman Building, 3031 Tisch Way, Suite 100,
San Jose, Calif. 95128 (408) 296-0868

Irvine, Calif.: Bruce C. P. Rayner
18818 Teller Avenue, Suite 170
Irvine, Calif. 92715 (714) 851-9422

Northwest: Paula Doe
5011 133rd Place SE
Bellevue, Wash. 98006 (206) 641-0903

London: Barbara N. Berkman
27 Paul Street
London EC2A4JU England 011-44-1-628-7030
Fax: 011-44-1-628-5984

PRODUCTION

VP Production: Wayne Hulitzky

Director of Production/Manufacturing: John R. Sanders

Production Supervisor: Andrew A. Jantz

Production Manager: Betsy Harkins; (617) 964-3030

CIRCULATION

Circulation Manager: Ann Ward
44 Cook Street, Denver, Colo. 80206
(303) 388-4511

Total Circulation: 77,804

REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Andrea Marwitz, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., PO. Box 5080, Des Plaines, Ill. 60018 (312) 635-8800
Electronic Business can be purchased on 35mm microfilm through University Microfilm Int. Periodical Entry Dept., 300 Zeeb Road, Ann Arbor, Mich. 48106

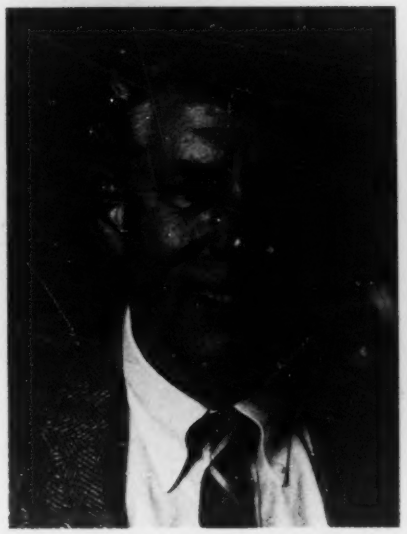
The '90s: No time for a breather

All of the reporting and writing for this special 1990s issue converges on a single point — in the next decade the electronics industry will finally affirm its global character.

The world projection map on our cover says it all. It is an original design for us, painted on Intel Corp. microcomputer boards by model maker Alan Burton, under the guidance of art director Mike Roach. The map symbolizes the task ahead for electronics companies in the '90s, particularly those in the United States — to respond vigorously and deftly to an inevitable series of global, economic and technological challenges.

For companies that measure up to these challenges, writes consulting editor H. Garrett DeYoung in his overview article, the years ahead promise unprecedented growth. For the companies that don't, there will be nothing short of upheaval and confusion. DeYoung, who authored the Xerox cover story in our Oct. 16 "Quest for Quality" issue, is a former senior editor of *High Technology* magazine.

We believe our '90s issue is not only an appropriate way to end the '80s, but that it also serves as a bridge to the decade ahead. Senior editor Bruce C.P. Rayner, in his article on the rapidly changing global economy, raises the question of where the United States will fit in the new world economic order. And London-based senior editor Barbara N. Berkman writes that, while globalization will force the melting of trade barriers of the past, significant questions of inflation, debt and oversupply loom ahead. Of course, key changes in an industry as technical as electronics will depend on innovation.



H. Garrett DeYoung, consulting editor

Contributing editor Dwight B. Davis finds that in the 1990s, as in the past, many of the industry's breakthroughs will be dependent on advances made in the silicon chip.

In this issue, we also look at individual market segments to see how fast they are likely to grow over the next 10 years. We thank Ralph Anavy, president of Electronic Outlook Corp., for the detailed data we use to illustrate these stories.

Other articles in this issue examine industry standards, demographics and education, financing and government's role in U.S. industrial competitiveness.

As Garrett DeYoung writes in his overview, managers of the '90s will barely have time to catch their breath. In developing and presenting these stories, we surely can see why.

MARVIN GREENE, section editor

ELECTRONIC BUSINESS® (ISSN 0163-6197) is published bi-weekly, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Senior Vice President/General Manager, Boston Division; Jerry D. Neth, Senior Vice President/Publishing Operations; J.J. Walsh, Senior Vice President/Finance; Thomas J. Dellamaria, Senior Vice President/Production and Manufacturing; Ralph Knupp, Vice President/Human Resources. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5800. Telephone: (303)388-4511. Second-class postage paid at Denver, CO 80206-5800 and additional mailing offices. POSTMASTER: Send address corrections to ELECTRONIC BUSINESS® at the Denver address. ELECTRONIC BUSINESS® copyright 1989 by Reed Publishing USA. Ronald G. Segel, Chairman and Chief Executive Officer; Robert L. Krakoff, President and Chief Operating Officer; William M. Platt, Senior Vice President. Annual subscription rates for non-qualified people: USA/Canada/Mexico, $69.95 per year; other countries, $110 per year (including air freight); $210 per year for air mail. Except for special issues where price changes are indicated, single copies of regular issues are available for $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5800. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Manufacturing • Foodservice & Lodging • Electronics & Computers • Interior Design • Printing • Publishing • Industrial Research & Technology • Health Care • Entertainment Specialized Consumer Magazines: American Baby • Modern Bride

BPA ABP

ELECTRONICS OUTLOOK FOR THE 1990s

Electronics in the 1990s: Still more new technologies, markets

Electronics will be the global economy's main engine during the next decade as today's technology leaders become mature industries. "Denser," "faster," "cheaper" still reign

BY BRUCE C.P. RAYNER

Think back to 1979 and the dawn of a new decade; it was a simpler world. A time before the personal computer, the workstation, local area networks, MIPS or optical disks. The rollercoaster ride of 1984 and 1985 was still a few years off. Semiconductor makers were struggling to reach 5-micron linewidth, and Intel Corp. had just introduced the 8086 16-bit central processor. And only a handful of hackers had heard of Scott McNealy or Bill Gates or a company called Apple Computer Inc.

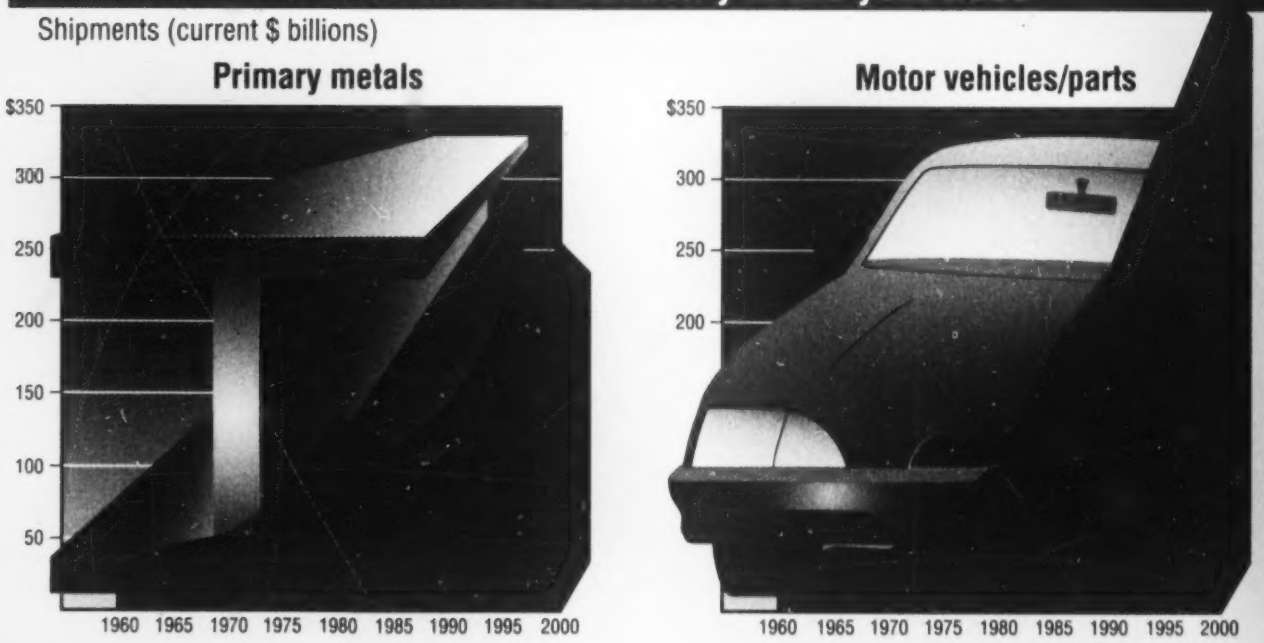
It was the dawn of yet another promising decade in electronics. From 1980 to 1989, U.S. electronics production more than doubled from $129 billion to $265 billion, according to the U.S. Commerce Department. Electronics output had more than doubled in the two previous decades as well. Today, electronics is larger than any other industry in the nation and has grown faster than both the automobile and steel industries during the past three decades.

Does the incredible speed of technical innovation imply that the electronics industry is fundamentally different from anything that has come before? Yes, says Ken Flamm, a senior fellow and industry watcher at the Brookings Institution in Washington, D.C. In the 42 years since John Bardeen, Walter Brattain and William Shockley of Bell Laboratories invented the transistor, electronics has literally transformed the world, Flamm says. It continues to spin off new markets and industries as it grows. In the not-too-distant future information technology will be the economy's driving force, he predicts.

So what awaits in the 1990s? What

Electronics will drive the U.S. economy to the year 2000

Shipments (current $ billions)



mind-boggling technological breakthroughs will occur? What new megacompanies will be shaping the way the world does business?

The major trends and opportunities are already discernible. "Denser," "faster" and "cheaper" will continue be the watchwords of the 1990s.

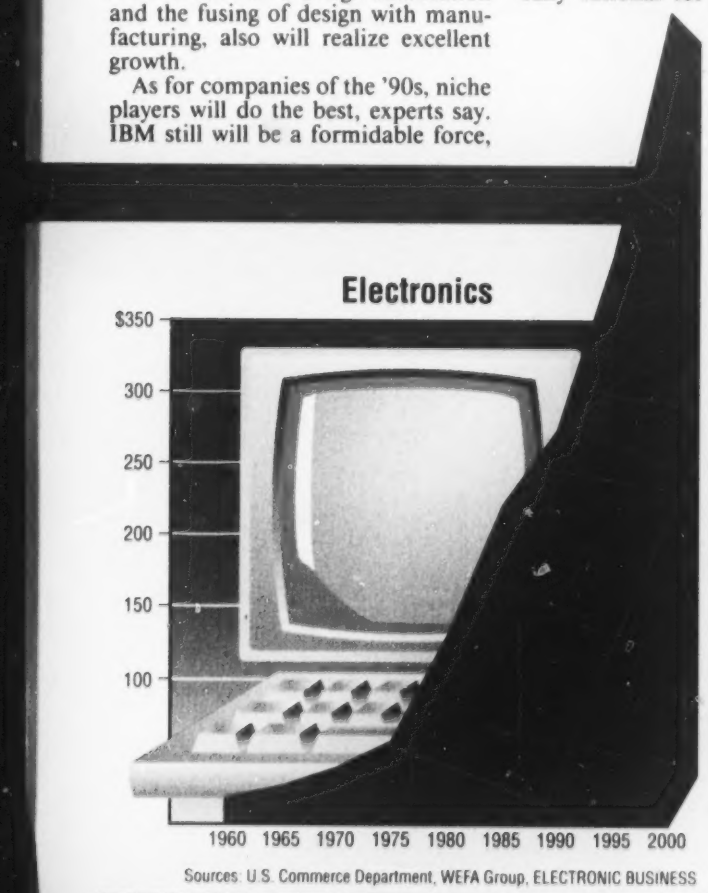
Products incorporating superconductivity will finally become commercially available, while massively parallel desktop computers and fiber-optic communication links will be commonplace.

Manufacturing electronics technology will also move into high gear as systems integrators become firmly entrenched as industry leaders. Computer integrated manufacturing, born in the 1980s, will hit its stride in the 1990s, as new standards are developed and compatibility improves. But a stagnant labor force and the need for better cost and quality control will also boost demand for CIM. Other areas of process technology, such as electronic design automation and the fusing of design with manufacturing, also will realize excellent growth.

As for companies of the '90s, niche players will do the best, experts say. IBM still will be a formidable force, but its structure will have changed. It will be working more closely with the U.S. government and with other leading-edge companies in a host of new technologies, particularly software, observers say.

At the same time, more and more U.S. electronics companies, like IBM, will become truly global in nature, with autonomous identities in all the markets they serve. Corporate national identities will fade. The same will be the case with Japanese and European companies. Companies like McNealy's Sun Microsystems Inc. will mature fast — having either survived or succumbed to cheap imitations from offshore — and other industry mavericks will be taking the reins of growth and innovation.

Small, nimble players will benefit most from new niche markets. It's the same old story: the status quo is too busy protecting its established lines and unwilling to risk its fortunes on a new innovative product that will threaten its lifeblood. "It is economically rational for old companies to be conservative about new technology," says Flamm of the Brookings Institution. The only way old-line companies will survive will be through acquisition and cooperative agreements.



Sources: U.S. Commerce Department, WEFA Group, ELECTRONIC BUSINESS

But in the latter part of the '80s, start-ups have had a difficult time finding financing. The venture capital community got burned in the mid-'80s when electronics hit the skids, and investors have since found a new sweetheart to swoon over — biotechnology. In total, only $1.38 billion was disbursed by venture capitalists in 1988 to electronics companies, down from $1.75 billion in 1987, according to Venture Economics Inc., Needham, Mass., a firm that tracks the venture capital industry.

Nonetheless, there are other sources of capital. Expect to see the British and Japanese lead the way in funding U.S. technology start-ups. Old-line Japanese companies are planning to enter electronics to keep an edge and are finding a good way to do that is by buying leading-edge U.S. companies.

Driving the economy

The most important development in the 1990s economy will be that electronics and other high-tech industries will drive the national and international economy in much the same way that automobiles and steel did in the past, says A. Gary Shilling, economist and president of A. Gary Shilling & Co. Inc., New York City.

There is much to support this prediction. The 1980s saw electronics become the largest industry in the country in terms of output. It is also the top employer. Today, electronics are in just about everything that is made and sold. What they are not in, they help make.

In terms of percentage of gross national product, the combined output of computers, telecommunications and components is equal to that of motor vehicles and equipment, says Michael Ramondi, director of computer market planning service at market research firm Data Resources Inc., Lexington, Mass. "Electronics has a significant impact on economic activity," he adds.

Remarkably, the industry has yet to mature. It went through the typical adolescent growing pains during the 1980s, searching for its identity — growing through a national recession and experiencing peaks and valleys of its own making. Between 1979 and 1989, electronics went through three business cycles, while the national economy had only one, says Madeline Franchi, an electronics economist with Cahners Economics.

Since the big shock of 1985, the industry has become more conservative in its planning. Inventory accumulation is watched more closely and philosophies such as just-in-time have helped to smooth out the spikes. Attention to quality and cost control "is the new corporate religion," says Kenneth McGill, senior economist at

The WEFA Group. After the ups and downs of the 1980s, the industry realizes it is no longer recession-proof, he says.

That awareness of fallibility will carry through into the 1990s as the electronics industry accepts the pivotal role it plays in the health of the economy. In general, expect the cycles of GNP and electronics to move more concurrently, economists say.

Along for the ride

Consumers and businesses will react to higher interest rates and changing exchange rates, and GNP will continue to undulate. But more than in the past, as the economy rises and falls, it will take electronics along for the ride. At the same time, if a revolutionary electronics product hits the market — a microchip that superconducts at room temperature, for instance — the economy will get swept up in the frenzy.

As most consumer electronics products are produced offshore, the domestic electronics industry will rely on capital equipment replacement to drive its growth. Capital spending will be slow coming out of the gate in the 1990s because of a general slowdown. But spending is expected to be strong later in the decade, as corporate profitability rebounds and companies invest in time- and labor-saving equipment. More than half of all capital spending will be for high-technology equipment, says economist Shilling.

Economists are forecasting slower and steadier GNP growth through the coming decade, so look for electronics to follow suit. According to Ralph Anavy, president of Electronic Outlook Corp., a San Francisco-based research firm, the U.S. electronic equipment industry will average 9.1% growth per year through the decade.

Small companies will benefit the most from new niche markets of the '90s because they are most nimble

That is well above the 2.5% to 3.0% GNP growth economists are forecasting, but down from the 10.5% average annual growth rate that the industry experienced in the 1980s.

The slower pace of growth has another cause: ubiquitous foreign competition. The 1970s and 1980s saw the ravaging of U.S. consumer electronics, the loss of the dynamic RAM market and inroads by foreigners in computers and office equipment. The 1990s will see some fierce fights and some further losses as both the Far East and Europe gain world market share in all areas including software and high-end computers.

For the first time ever, 1990 will see the Far East outproduce North America, says Anavy. In current dollars, Japan and the Far East will manufacture $272 billion worth of electronics equipment compared with $252 billion in North America. By the year 2000, the Far East will account for 37% of the world's electronic equipment production, compared with 23% for North America.

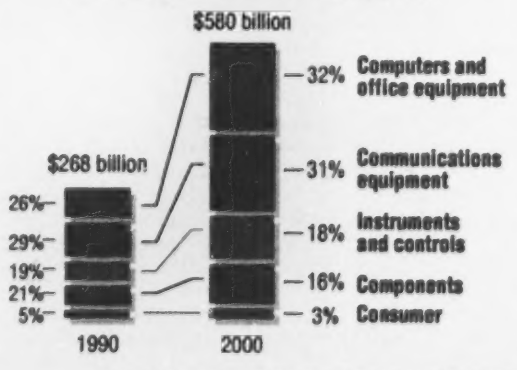
But that doesn't mean that only Far East companies will profit. The whole globalization phenomenon — what used to be called multinational corporations — means that U.S. companies and Japanese companies will make decisions not on national criteria but global criteria. "The more successful companies will become truly global in manufacturing and marketing," says Anavy. That's OK for the companies, but not so good for U.S. manufacturing employment. Manufacturing accounts for only abut 20% of total GNP and is expected to decline further in the 1990s.

As electronics gains in economic importance, it also gains in political importance. Some politicians are warning that economic strength is tantamount to national security. While there is

The changing composition of the electronics industry in the 1990s

The U.S. electronics industry will more than double in size by the year 2000...

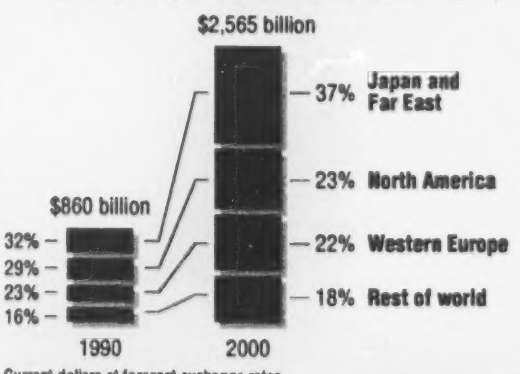
(Percentage of total U.S. electronics production)



Sources: U.S. Commerce Department, ELECTRONIC BUSINESS

...but the Far East's share of worldwide production will increase to 37%

(Percentage of total worldwide electronics production)



Current dollars at forecast exchange rates

Source: Electronic Outlook Corp.

always danger of too much government control, increased government involvement will help to counter the short-term myopia that plagues the industry.

R&D issue

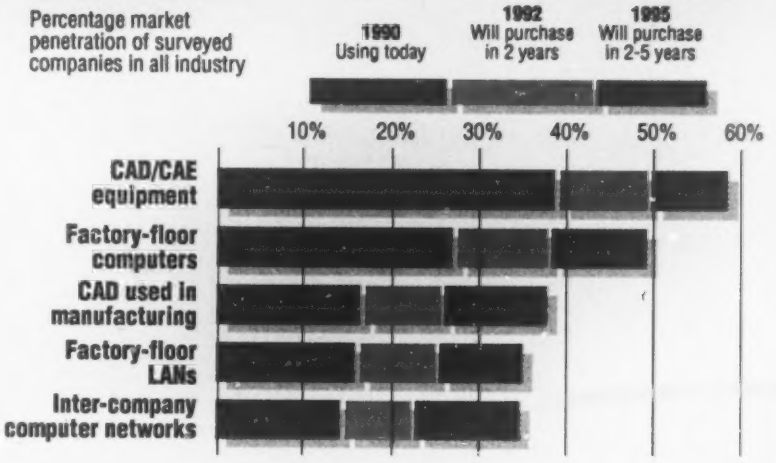
One major concern in Washington is the slide in the level of domestic research and development. As cost control became an issue in the 1980s, R&D spending came under the knife. U.S. industry in general still spends more on R&D than Japan, Germany, France and Britain, says Carlos Kruytbosch, director for science indicators at the National Science Foundation, but in terms of percentage of GNP, they are all fairly even. What is most worrisome now, he says, is that in the United States spending is now declining as a percentage of GNP while that of its trading partners is rising.

Even though low spending on research and development is a sign of weakness, there is little expectation for a major reversal. Don't look for increased government funding as the budget crunch will be a constraining factor throughout the decade. The Pentagon, the one government agency that spends heavily on R&D, is expected to cut back by $10 billion between now and 1999.

Still, the government will be expected to pitch in. Congress made the R&D tax credit permanent this year, and it could offer tax cuts in the future for capital spending and R&D. However, government support for R&D and production consortia may increase slightly in the 1990s. Also watch for the unfolding of a "national industrial policy," some government watchers say. The plan most likely will include tax breaks and incentives and will involve the government in the long-term development of key technologies. Chances are it will involve a Sputnik-type challenge for the revitalization of technical education as well as a firmer policy on trade. However, it all depends on the strength of political leadership.

However, some industry watchers fear that too much government meddling could backfire. If protectionism takes hold — and there is a good chance it will — then national boundaries will be erected around markets, stifling trade and economic growth. Global corporations will have to make do with inefficient allocation of their resources and international joint ventures will be attacked.

Increasing industrial demand for electronics



Source: U.S. Commerce Department

While electronics on the whole will see slower growth in the next decade, each industry segment has a life of its own. According to Electronic Outlook, semiconductors will see the highest growth rate throughout the decade at an average annual rate of 13.9%. Communication equipment, too, will see strong growth of 11.57% a year. On the other hand, government and military electronics will be the industry laggards at just 4.72% as a result of a slowdown in defense spending.

Some industry watchers fear government meddling in electronics could backfire

In semiconductors, watch for heterostructure transistors (HET) — a technology that uses dissimilar materials to form transistors — to take the semiconductor industry by storm. The HET IC market will grow from $20 million today to $25 billion by the year 2000, according to Ken Taylor, director of semiconductor research for Henderson Ventures in Los Altos, Calif. The advantages over homostructured transistors include superior performance, lower power consumption and smaller equipment.

In general, the decade will ride the trend toward smaller and faster chips of all types. The Technology Research Group Inc. forecasts 0.35-micron linewidth and 9-inch wafers by the year 2000. Also, expect to see the 16-megabit DRAM by the the middle of the decade and the 64Mb DRAM by the year 2000.

Throughout the 1980s, communications has been a hot growth market, with the breakup of the telephone monopoly and the advent of voice and data networking. Networking will continue to lead the industry growth as more and more factories and offices are tied together via fiber optics. Watch for growth in the installation of fiber-optics trunks that connect groups of cities. Work is being done on a network for Seattle, Portland and Sacramento and for Cleveland, Cincinnati and Columbus, says Ramondi.

In computers, strongest spending is likely to be in computer-aided design equipment and factory-floor computers, says a Commerce Department survey. Also, watch for strong growth in the electronic design automation market as vendors tie the various parts of the design cycle together and network multiuser systems, says Cindy Thames, executive vice president of The Technology Research Group. □

GLOBAL TRADE ISSUES

Globalization forces changes in trade barriers of the past

As the world continues to "shrink" and nations' economies meld together, international trade will play an even greater role. The challenge for these integrated economies will be to weather the forces of inflation, debt and oversupply

BY BARBARA N. BERKMAN

Say good-bye to the international trade patterns of the past. Old trade barriers will melt away in the 1990s, along with the 1992 border smashing within the European Community (EC), the bilateral trade agreement between the United States and Canada, economic reforms within the Soviet bloc and the conclusion of major rounds of trade negotiations.

Even now the globalization of markets is taking place. Structural, monetary and technological developments are all redrawing the map of trading relationships. The result is that by the 1990s markets will show more economic interdependence than ever.

As the world continues to "shrink," international trade is swelling to even greater importance. The value of world merchandise exports reached $2.9 trillion in 1988, with $2 trillion from manufacturing trade. The share of manufacturing in world merchandise trade will have jumped from 55% in 1980 to more than 70% by the end of this decade, according to the General Agreement on Tariffs and Trade (GATT) in Geneva, the international body that negotiates multilateral trade agreements.

To be sure, the trade patterns of the 1990s are impossible to predict. Semiconductor imports to the United States grew by 44% from 1987 to 1988, but who can say whether the combined success of consortia efforts such as Sematech, joint ventures and trade talks won't change the trade outlook of the 1990s? Similarly, in response to local content rules, the Japanese are producing more semiconductors in Europe. By the next decade that shift will effectively reduce the gross rate of Japanese semiconductor imports to Europe.

What is certain is that the 1990s will be the decade of international economic cooperation. Globalization will blend the economy of one country into another. It will make trade between regions easier, so that trade between Scotland and Pakistan, for example, won't be much different from trade between Scotland and Wales. Traditional groupings — such as developing and developed economies — will have less meaning.

Globalization has already clouded the precise national identity of exporting companies. IBM, for example, has a high percentage of international sales. But should those sales be considered U.S. exports or domestic exports of IBM France or IBM Canada? More companies will follow IBM down the path of globalization, so that the sharply rising share of national output sold in world markets will make the trade patterns of international commerce tougher to analyze.

More so than in past decades, policy changes in one country will have repercussions in another. Trade experts have placed the need to minimize trade frictions and to avoid protectionism high on the agenda of the 1990s. But the solutions to those solutions hinge on the success of the current talks of the GATT multilateral trade negotiations.

If the talks don't reverse the drift toward trade intervention, protected regions such as "Fortress Europe" could materialize. But if they succeed, a market such as Europe will have a strengthened open multilateral trading system. "Regionalism

would take a backseat to multilateralism," GATT's chief economist Richard Blackhurst predicts.

Two trends are clear. The first is that technological advances in the production of goods and services will increase world trade in capital goods in the 1990s. Second, the continued encouraging outlook for the world economy of the 1990s is based on limiting Third World debt, reducing the trade deficits of the leading trading nations, checking inflation and easing protectionism.

The technology of the 1990s will widen the kinds of goods and services traded internationally. Technological innovation will continue to develop new tradable goods such as high-definition television (HDTV), and services such as communications. Advances in communication and transport will continue to increase access to markets.

Major financial markets will be interdependent as improved datacommunications lets billions of dollars slip unhindered across borders in daily currency and stock transactions. Technology will even boost trade by changing the way business is done. Better communications are making it easier to strike cross-border agreements for marketing, production, mergers and technology sharing.

Booming capital goods

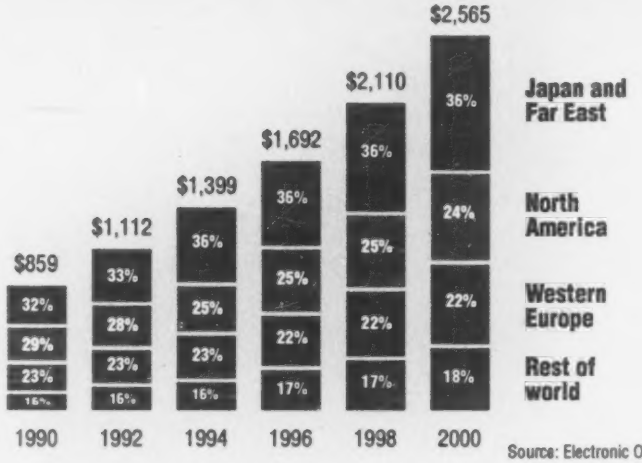
In the late 1980s the four largest traders of capital goods — the United States, West Germany, Britain and Japan — experienced a boom in domestic direct investment and in their trade in capital goods. The reason is that many companies either upgraded or replaced existing capital equipment because of obsolescence or capacity constraints. That, increased investment in equipment during the late 1980s will fuel even more trade in world capital goods.

But the current boom in service exports — now 20% of all world trade — will also make its mark on capital goods. Even now, world exports of services are expanding at an average annual rate double that of merchandise trade. That growth is giving momentum to office and telecommunications equipment, the major capital goods used by service industries. Already those products are the fastest growing components of capital goods exports, according to GATT.

The rate of growth has been even more pronounced in developing Asian countries. In 1987, the latest year statistics are available, office and telecommunications equipment made up 60% of capital goods exports from Asia, compared with 22% from developed countries. That compares with a 47% share for Asia and a 14% share for developed countries at the beginning of this decade.

Worldwide electronic equipment production

Production values at forecast exchange rates (current $ billions)



Source: Electronic Outlook Corp.

One benchmark of the next decade is a shift in where Japanese goods are manufactured

By the next decade all these goods flowing easily across borders will encourage export-driven development policies and more efficient production worldwide. Oversupply won't be far behind. The result: fierce competition among regions that have an increasing appetite for exporting.

In 1987 and 1988 world exports of electronic products expanded annually in dollar terms by roughly 25%, according to the GATT. East Asian countries recorded the highest export and import growth. The third tier of newly industrialized nations — Thailand, Malaysia and Indonesia — are following in the footsteps of Japan, Hong Kong, Singapore, South Korea and Taiwan. Not far behind are Vietnam, India, Mexico and some of the other Latin American countries.

Japan Inc.

Market access will remain a source of friction throughout the 1990s. U.S. industry believes that Japan has a structural advantage: it has far easier access to the U.S. market than U.S. companies have to its market. Many U.S. companies with leading-edge technologies are doing well in Japan. Others could succeed, if they could only gain entrance to Japan, especially highly protected markets such as supercomputers, jet fighters and aerospace.

Japan Inc.'s steamroller over the rest of the world's share in electronics trade is slowing. "The kind of growth in net exports of Japan is a thing of the past," notes Frank Weiss, head of research on international economic policy at the Kiel Institute for World Economics in Kiel, West Germany. "Japan is not as super rich as we make it out to be."

Yet in 1988 Japan's share of electronic products in its economy's total merchandise exports was 22%, or $50.9 billion, compared with 13.5% in 1980. Japanese trade in the 1990s will shift sharply toward value-added electronics products, such as HDTV, GATT predicts. Consumer electron-

ics manufacturing will move to Thailand, Malaysia and Korea.

One benchmark of the next decade is a shift in where Japanese goods are manufactured. Europe will be the beneficiary of Japanese direct investment in manufacturing sites. "It is unlikely that Japan will make such inroads in Western Europe and the United States as in the past," says Michael Finger, a counselor in the GATT economic research and analysis unit. "It is already at such a high level of penetration that the next step is to produce locally." Local production of Japanese goods in Europe will be a first step in reducing the current trade deficit of $23 billion between Japan and the EC.

It is yet unclear whether protectionism in Western Europe will prevent consumer electronics imported from the developing Asian countries to saturate the market the way Japanese VCRs and televisions flooded the United States. Consumer electronics companies such as N.V. Philips' GL of the Netherlands "doesn't want to lose its home base," Finger says. "Europeans still have something to lose. No one foresees a similar situation in Europe as what happened in consumer electronics in the United States."

Japan is willing to produce locally. But Japan's trading partners seem unsure whether to put out the welcome mat or stake up the No Trespassing sign. Terrified of dumping, the EC slapped Japan with 14% tariffs on semiconductor imports this year. If the EC ever gets serious about removing the tariff, European chip producers will put up a tough battle.

Will this uninhibited Japanese expansion serve as a cure-all for European trade deficit ills? A recent study by Nomura Research Institute predicts that manufacturing site investment by Japan in Britain, almost $4 billion last year, will grow to more than $10 billion by the end of the 1990s. In its optimistic forecast, the brokerage house predicts that Japanese investment will cure the British trade deficit, turning it to a surplus in just six years. By the year 2000 Japanese investment will account for about 10% of manufacturing output and ease inflation, the institute says.

Such benefits are attractive, and European and U.S. local governments continue to court Japanese investment dollars. Yet they're concurrently stepping up support for joint research efforts aimed at slowing Japanese domination in semiconductors and HDTV. Because of those factors, it is difficult to extrapolate Japanese investment flows on the experience of the 1980s. The current trend: Direct investment in manufacturing alone shot up 76% over 1987. Overall Japanese direct investment in 1988 was a whopping $47 billion, with $21 billion going into the United States, $5.6 billion in Asia and $9.1 billion in Europe, according to Japan External Trade, a Japanese business group.

Globalization has already clouded the precise national identity of exporting companies

The Soviet Union, which will see a 19% population growth between 1987 and 2010, according to EC estimates, offers a potentially strong consumer market. But current reforms don't mean that the Eastern bloc countries will have hard cash on hand in the 1990s. Comecon, the 17-nation group that oversees trade in sensitive technology, might ease its security restrictions. But it is unlikely that the Eastern bloc countries can absorb a broader range of electronics products.

As for exports, technology from East Germany and the Soviet Union is finding fewer markets. Pricier and of poorer quality than low-cost goods from the developing Asian countries, the technology of Soviet bloc electronic products continues to slip leagues behind the West.

The more the Soviets westernize their markets, the more burdensome it is for Eastern bloc electronics companies to compete with the quality and technology of the West. Take East Germany's precarious position. As 1992 looms, Western Europe has fewer incentives to import East Germany's manufactured goods when it can get cheaper, better quality products from other Eastern bloc nations.

The East German government has already loosened controls on joint ventures with the West, and this

Get A Hands-On Demonstration of The CAM Workstation That Beats The Others Hands Down.

The SeriCAM™ workstation from Du Pont has it all over the competition. First, because it's remarkably flexible. And second because it costs thousands less than other workstations.

Designed to work specifically with Du Pont's SeriFLASH™ Projection Direct Imager, SeriCAM is also compatible with all major plotters. Including Gerber, Optrotech, Excellon, MacDonald Dettwiler, and Optronics.

SeriCAM improves productivity by letting you electronically edit circuit designs. Adjust features. Step-and-repeat the design. Merge it with venting patterns and test coupons. And optimize panel configurations for maximum efficiency.

SeriCAM also has a complete library of venting patterns, and the flexibility to design custom venting patterns which can be stored in the system's database.

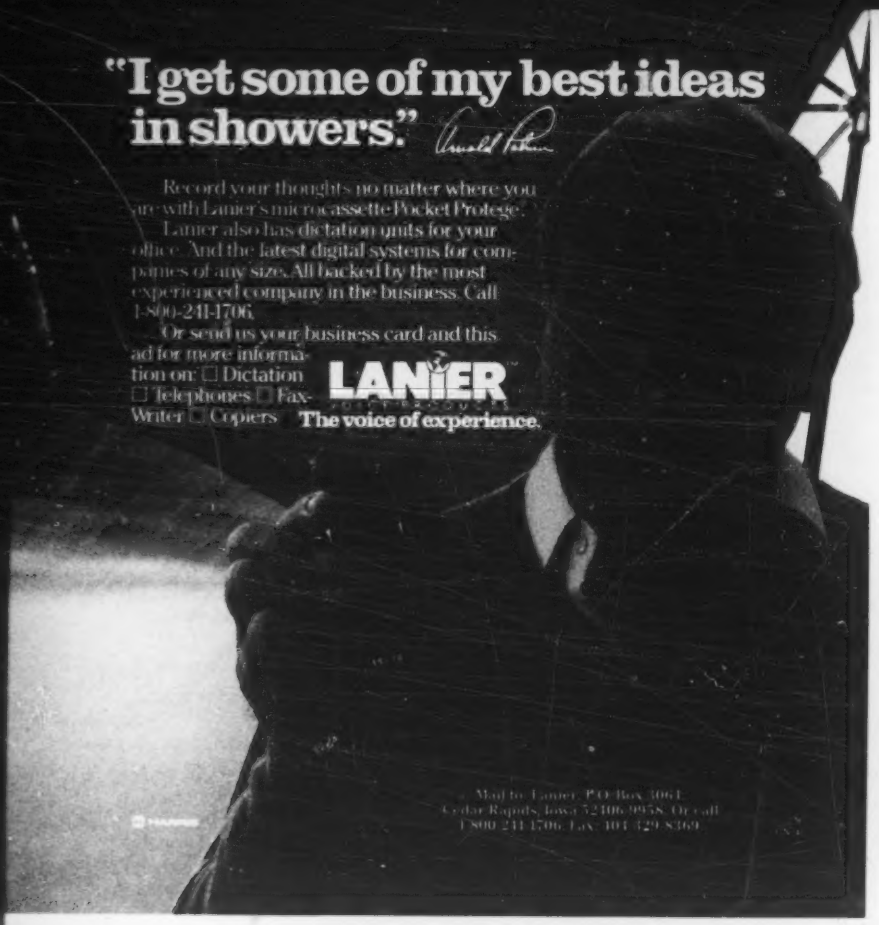
Best of all, SeriCAM is easy to learn. It requires no special knowledge of computer language or operating systems. And all commands are in English.

Call for a hands-on demonstration of SeriCAM. The compatible workstation that gives you substantially more—for thousands less.

To arrange a free demonstration or for more information, call **1-800-654-4567 Ext. 721.** Or write Du Pont Company, Room G-51802, P.O. Box 80029, Wilmington, DE 19880-0029.

Du Pont Electronics
Share the power of our resources.

DU PONT


"I get some of my best ideas in showers."
Record your thoughts no matter where you are with Lanier's microcassette Pocket Protege.
Lanier also has dictation units for your office. And the latest digital systems for companies of any size. All backed by the most experienced company in the business. Call 1-800-241-1706.
Or send us your business card and this ad for more information on: ☐ Dictation ☐ Telephones ☐ Fax-Writer ☐ Copiers
LANIER
The voice of experience.
Mail to: Lanier, P.O. Box 3064, Cedar Rapids, Iowa 52406-9958. Or call 1-800-241-1706. Fax: 404-329-8369.

GOOD
BETTER
BEST
NordicTrack is the Best
Here's the evidence . . .
A major university laboratory concluded NordicTrack users burned more calories and obtained significantly more cardiovascular exercise than from any other machine tested.
More complete workout than an exercise bike.
NordicTrack provides upper-body exercise missing when sitting on a stationary bike.
Safer, more thorough exercise than a rowing machine.
Unlike rowing machines, NordicTrack's arm and leg resistance can be adjusted independently so you can set the tension ideally for your arms and legs. No lower-back pain with NordicTrack.
Best way to lose weight
Aerobic exercise is the most effective way to lose weight. Because no other exercise machine burns more calories than NordicTrack, you can lose weight faster without dieting.
Duplicates the world's best exercise — cross-country skiing.
Even if you've never skied, in a few minutes you'll soon be "tracking."
Stores in only 17 × 23 inches floor space and unfolds in seconds.
FREE BROCHURE AND VIDEO
Call Toll-Free or Write:
1-800-328-5888
In Canada 1-800-433-9582
141 Jonathan Blvd. No., Chaska, MN 55318
☐ Please send free brochure
☐ Also free videotape ☐ VHS ☐ BETA
Name
Street
City State Zip
Phone ( ) 144L9
NordicTrack
© 1989 NordicTrack A CML COMPANY
Bill Koch
Olympic
Silver Medalist

could put the country in a better position to compete with other Eastern European industries. Such joint ventures could accelerate its current struggle to develop a 4-megabit chip by the 1990s. Still, it could be a while before the country's economic structure and trading relationship with the West and other Comecon countries are liberalized.

Agendas still conflict

As for inflation, oversupply and debt in the economy of the 1990s, world economic integration will be the byword. The common challenge will be to promote job-creating growth and maintain low inflation.

Growth in the gross domestic product (GDP) of Western countries in the Organization for Economic Cooperation and Development is decelerating, down to 4% in 1988 from 5.25% in the second half of 1987, says the OECD. Inflation will be a key challenge. Inflation in OECD countries this year picked up by almost one percentage point over 1988. The OECD projects average inflation at 4.5% in 1990. Pockets of high inflation include the double-digit enclaves of Greece and Portugal.

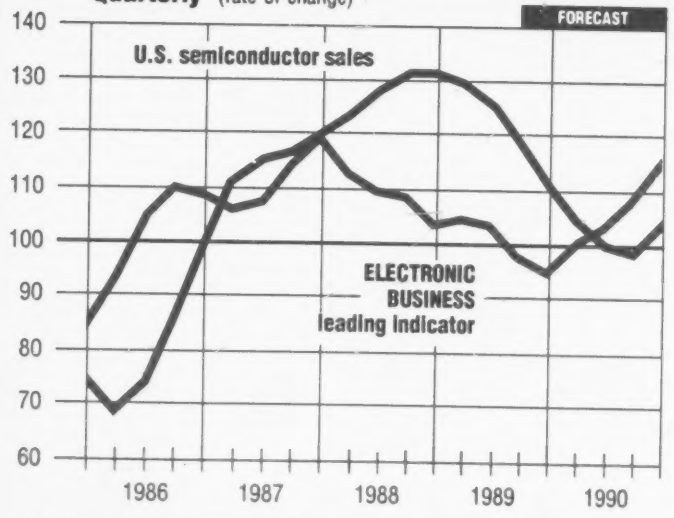
In Japan the key challenge is facilitating imports through regulatory reform that improves market access, particularly in distribution, transport and telecommunications. By 1990 the EC predicts the GDP of Japan will grow 3.6% over the previous year, compared with 2.6% in the 12 EC countries and a 1.7% rate in the United States.

The growing interdependence of world markets — international economic cooperation — is a major challenge of the 1990s. But as long as the rules of the trading game are skewed in favor of one or more of the major nations — that is, as long as some nations play by the rules of free trade and others play by the rules of managed trade — there will be little chance of ensuring sustained, low-inflation growth and access to markets for all the players.

It's still too early to know whether everyone will be forced to play by the same rules, although the years after 1992 are sure to give some answers. Far more certain is the warning that any company that misses the implications of the fast-changing trade landscape might as well forget about joining the game at all. ☐

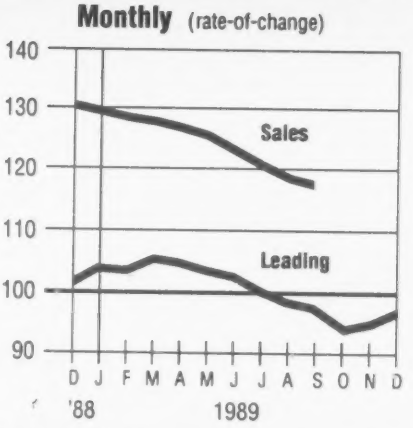
ELECTRONIC BUSINESS leading indicator

Quarterly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator predicts turning points in U.S. semiconductor sales with about a three- to nine-month leadtime. For more information please contact Elizabeth Baatz, senior economist, Cahners Publishing Co., 275 Washington St., Newton, Mass., 02158, or call (617) 558-4368

Monthly (rate-of-change)



The ELECTRONIC BUSINESS leading indicator fell to 97.4 in August, down from a revised 99.1 in July. Since the previous turning point set in October of 1987, the indicator has dropped 22.6 points. Leadtimes for electronic components and bookings for U.S. semiconductors have contributed the most to the decline.

Source: Cahners Economics

Electronics industry indicators this month

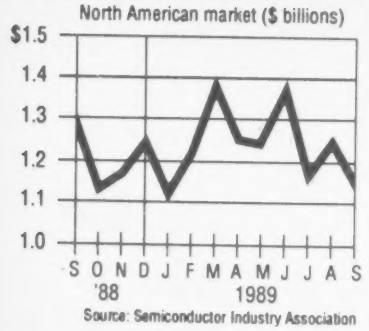
	Latest month	Previous month	Year ago	1988 average
ELECTRONIC BUSINESS leading indicator (rate-of-change, Aug.)	97.4	99.1	108.6	107.6
U.S. semiconductor bookings ($ millions, 3-month average, Sept.)	$1,153	$1,155	$1,169	$1,178
Weekly hours of semiconductor production workers (monthly average, Aug.)	39.8	39.1	40.1	40.2
Electronic components leadtime index (1977 = 100, Oct.)	75.4	89.1	109.4	108.9
S&P's semiconductor stock price index (1970 =10, monthly average, Sept.)	58.0	57.5	51.0	54.4
Change in electronic components inventories ($ millions, SA, Aug..)	+$78	+$178	+$115	+$80
Contracts and orders for plant and equipment ($ billions, SA, Aug.)	$41.9	$46.0	$43.8	$39.7

SA = seasonally adjusted, all other data is not seasonally adjusted

Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Commerce Department, U.S. Bureau of Economic Analysis

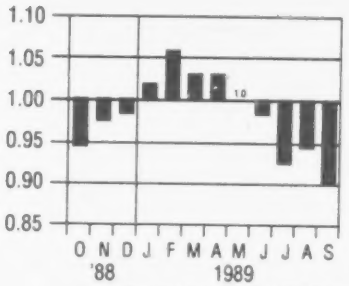
Semiconductor sales

North American market ($ billions)



Source: Semiconductor Industry Association

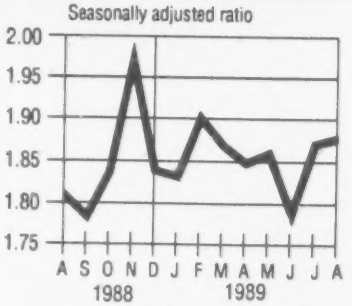
Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipments

Seasonally adjusted ratio



Source: U.S. Commerce Department